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31 Dec

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REMARKS: Attached for your information is the I/GM contribution to the paper requested by the President on the history of the Soviet guided missile program. This paper was approved in draft by [redacted] on 30 December.

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Approved For Release 2001/08/27 : CIA-RDP70T00666R000100090001-5

THE HISTORY OF THE SOVIET LONG-RANGE GUIDED MISSILE PRODUCTION PROGRAM

I. Introduction

Since the inception of the Soviet guided missile program following World War II, the industrial effort devoted to this growing program has been effectively obscured from the West by rigorous Soviet security measures. There is very little direct evidence available regarding the location, magnitude, and pace of the Soviet production program for long-range missiles at any stage of its development. Such information as is available consists principally of inconclusive fragmentary data or indirect evidence subject to conflicting interpretations.

On the other hand, the broad development and major historical trends of the post-war Soviet industrial economy are relatively well known. It is abundantly clear that Soviet industry has grown very rapidly since regaining its pre-war level by about 1949; that heavy industry has been emphasized during this period of growth; and that much of the known increase in industrial production has occurred in industries of key importance to a large-scale guided missile production program, such as electronics, machine tools, chemical equipment, and precision instruments. Furthermore, there is sufficient evidence available concerning the test firing programs for long-range missiles of both Kapustin Yar and Tyuratam to permit inferences to be drawn with some confidence regarding the probable timing of production programs; certain minimum rates of output which must have been achieved merely to support known test programs; and some of the industrial activities which must have taken place, even in the absence of evidence, in order to account for the state of development demonstrated at the test ranges.

This information leads to the firm conclusion that the USSR has all of the necessary resources to be capable of producing a variety of long-range missile weapon systems in large quantities if it chooses to do so. Moreover, the evidence indicates that Soviet ballistic missile production programs have been in existence since at least 1951 and that a sizable and growing production program for missiles of 700 n.m. through intercontinental range has been in progress throughout 1958 and 1959.

II. The Pre-1945 Period

At the end of World War II, the Soviets had no known guided missile program. During the 1930's, however, the Soviets had pioneered in the design and production of solid fuel, unguided

field rockets and recoilless weapons. These rockets, known as "Katooshas", were used extensively in the defense of Leningrad and Stalingrad. They were instrumental in halting the German advance and in forcing the German withdrawal from the Soviet Union. An estimated 500,000 rockets were produced annually by the USSR from 1942 through 1944.

III. 1945 -- 1949

The period immediately following World War II marks the beginning of the Soviet guided missile program and it was during this period that the foundations were laid for the missile production program which was to follow in later years. Soviet activity during this period was characterized by an exploitation of German missile personnel, facilities and production technology. This exploitation had as its goal the training of Soviet personnel and the initial organization of human and material resources which would permit the USSR to establish a native missile production capability.

In 1945, the Soviets seized almost all of the German V-2 manufacturing facilities, as well as existing German operational and prototype missiles, equipment and technical studies. The dismantling and shipment of these facilities and equipment to the USSR started in 1946, shortly after the deportation of some 400 German missile engineers. Much of the equipment was installed at Scientific Research Institute (NII)/Plant No. 88, in the Moscow suburb of Kaliningrad, where the initial activity was to inspect, test and repair German components and assemble, with German assistance, V-2 missiles. The power plants for these missiles were reassembled and modified at Plant No. 456, Moscow/Khimki. In the fall of 1947, the Soviets test fired 10 to 15 V-2 missiles.

Although the main activities of Plant No. 456 were concerned with the V-2 propulsion systems, during 1946-47 considerable numbers of V-1's were reportedly assembled at this plant. These were made entirely of German parts and there was no attempt at series production for operational purposes. 25X1D1a

25X1D1a [redacted] but it is unlikely that the Soviets ever produced any quantity of these obsolete World War II weapons.

Soviet exploitation of the German missile program undoubtedly hastened by a number of years the development of a Soviet ballistic missile capability. Because the Germans were isolated from independent Soviet missile activity and from any information on Soviet production programs, little is known directly of Soviet progress during this period. However, there is no evidence of quantity production of ballistic missiles of any kind for operational purposes during the period 1945-49 and it is probable that

the missiles which were produced during this period were solely for research and development purposes.

IV. 1950 -- 1954

By 1950, the Soviets were thoroughly familiar with the German missile program and were phasing out the German missile specialists. Although some German missile work continued in the USSR, it was not primarily concerned with ballistic missiles. The phasing out of the German specialists in 1950 indicated that the Soviets felt capable by that time of carrying on a native missile program. The extent of Soviet progress during the immediate post-war period is reflected by the ability of the USSR to organize and probably to begin series production of an improved V-2 ballistic missile during 1950 and 1951.

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Evidence [redacted] indicates that preparations were being made for the series production of short-range ballistic missiles at the Dnepropetrovsk Automotive Plant (DAZ) at least by the latter half of 1950; that production of these missiles or rocket engines or both probably began in 1951 and continued into 1953; [redacted]

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The extent to which the Soviet decision to establish a facility for the quantity production of short-range ballistic missiles at this time was occasioned directly by the outbreak of the Korean War cannot be determined. However, it is known that the Korean War had a considerable impact on the Soviet industrial economy and that a substantial number of industrial facilities were converted from civilian to military production. It is probable, therefore, that the Korean War was instrumental in the conversion of the DAZ plant to missile production and that the Soviet leadership desired at that time to have available an operational ballistic missile weapon system or at least the capability to produce such a system in operational quantities, if required.

There is no information on the rate of output at DAZ during the period 1951-53 or on the total number of missiles produced. Moreover, there is no evidence whatever concerning the introduction

of ballistic missiles into the Soviet military forces at this time. In any case, the total production could not have been very large. It is probable that the end of hostilities in Korea and the growing obsolescence of this missile resulted in the phasing out of production by sometime in 1953.

The reorientation of Soviet industry following the death of Stalin in early 1953 also directly affected the history of this early Soviet ballistic missile production program. In late 1953 a substantial portion of the DAZ plant was converted to the production of tractors as the result of decrees by the post-Stalin leadership which were aimed at overcoming critical weaknesses in Soviet agriculture. The plant apparently became a major producer of tractors from 1954 on, and it is probably still producing a sizable number of tractors.

Despite this partial shift in the activity of DAZ, available evidence indicates that the plant continued to be involved in the missile production program throughout 1953 and 1954.

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The testing activity indicates, however, that a transition to long-range ballistic missiles was well underway in the USSR by the end of 1954.

V. 1955 -- 1960

A. Introduction

At the beginning of 1955, the Soviet economy was in the closing stages of the Fifth Five Year Plan (1951-55), which produced a very rapid industrial expansion. During this plan period, the average annual rate of increase of industrial production in

the USSR is estimated to have been about 11 percent. Output rose sharply in all producers goods, such as metal-cutting machine tools which increased more than 65 percent during this plan period. Sharp production increases also occurred in electronics, chemical equipment and other industries essential to the support of a growing guided missile production program. Since 1955, Soviet industrial growth has continued at a rapid, although slightly lower rate, with much of this growth taking place in the industries which would make important contributions to a large-scale ballistic missile production program. In the electronics industry, for example, the estimated total value of production more than doubled between 1955 and 1959. This period of industrial growth has provided the USSR with a broad and expanding industrial base for the production in quantity of advanced weapons systems.

The industrial capability of the USSR to produce a variety of long-range ballistic missiles has been proven in the period from the beginning of 1955 to the present time. This capability is evidenced in the history of the 700 n.m., 1,100 n.m. and ICBM firings at Soviet test ranges, which has demonstrated conclusively that the USSR possesses the industrial and scientific skills, as well as the production facilities and resources, to carry out an extensive and on-the-whole highly successful long-range ballistic missile test and range training program. In the aggregate, over 200 long-range ballistic missiles have been test-fired since the beginning of 1955. This implies a production program of perhaps 350 missiles in support of testing activity alone, without regard to production for operational use. [redacted] 25X1D1a

25X1D1a & NSA [redacted] a sharp increase in total production activity can be inferred, beginning in 1958 and continuing through 1959. This reflects the development to operational status of both the Soviet 1,100 n.m. missile and the ICBM. Over 60 percent of the total firing activity to 700 n.m. or more since 1955 has occurred during 1958 and 1959.

B. The Establishment of Serial Production Facilities for Ballistic Missiles: Soviet Production Organization and Philosophy

Although direct evidence on production and operational deployment of Soviet long-range missiles continues to be lacking, there is sufficient information [redacted] 25X1D1a & NSA

25X1D1a [redacted] to permit judgments of the probable general organization of the missile production program and to indicate the approximate dates by which major milestones must have been reached for each long-range missile system. This programming is illustrated in Figure 1, which provides in simplified format the time relationship of the various major elements of each of the Soviet long-range missile programs. 25X1D1a & NSA

There are two fundamental production philosophies which are consistent with known weapon system programming and production practices in the USSR. The first concept, which the Soviets are known to have employed in the production program for the Moscow surface-to-air missile system, calls for production of initial research and development missile hardware at a research institute, "design bureau" or "experimental plant", with a separate facility organized and tooled for production. Output of the initial hardware from the research and development facility is usually limited, owing to its method of production and its developmental nature. The decision to designate the quantity production facility and organize the elements of series production, i.e., basic tools and tooling, trained labor cadre, etc., can occur anytime from well before the first flight tests of the missile to after the operational configuration has been confirmed. When the production facility is committed at an early date, that is to say, parallel to the development program, its output is normally committed to fulfill the hardware requirements for the test program until such time as production for operational inventory begins.

The second concept of production organization, which is also familiar to the Soviets, assumes that a basic decision would be made very early in the program that quantity production and operational deployment were definite objectives to be achieved as soon as feasible. This would call for committing industrial resources from the beginning of hardware development. In this instance, all missile production, whether for research and development or operational purposes, would take place at the same facility with the first missiles produced being designated for initial developmental testing and firing, and later units for delivery to operational inventory.

The evidence is inconclusive as to which concept the USSR has adopted for each of its long-range missile production programs. Even if the parallel facility concept has been employed, [redacted] the separate facilities are probably organized more or less concurrently rather than consecutively. Accordingly, this method of organizing production can provide the same major advantages as the single facility method, in that it considerably reduces the lead-time from the successful completion of development to deployment of operational missiles in the field, and it also provides a more economical means of producing most of the hardware requirements of the development program, particularly the large number of missiles required for flight testing. The primary disadvantage of this compressed production program lies in the possible risk of committing economic resources to the production of a development item which may not survive the development phase.

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c. The 700 n.m. Weapon System Program: Industrial Implications

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[redacted] a test program for a 700 n.m. weapon system was already underway. Because of lead-time considerations, the initial fabrication of the missiles fired in late 1953 must have been started by spring or early summer of that year. It is possible that the 700 n.m. missile program was begun even earlier, since it is not known when the first firing of this missile actually occurred. In any case, experience was probably drawn from the shorter range missile programs.

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From an industrial standpoint, the [redacted] missiles are by far the most significant. The fact that 24 firings of [redacted] missiles occurred in the first year of testing indicates a rate of missile production which would require production methods generally not associated with limited quantities of prototype development hardware. These missiles were in all likelihood produced by assembly line techniques from prepared tooling, jigs and fixtures. Consequently, it is probable that a quantity production facility for this missile had been established not later than 1954, although there is no evidence of series production for operational purposes until about 1956.

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Since January 1955, there have been about 130 firings of the 700 n.m. missile, of which over 75 percent have been the [redacted] missile. The minimum production output required to sustain the test program alone would amount to a peak rate of about 3 missiles per month. Considering the requirements resulting from maintenance, pipeline, static test, and training attritions, a rate of about 5 missiles per month is considered probable, on the basis of test firings alone.

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It is currently estimated that the initial operational capability of the 700 n.m. weapon system took place sometime in 1956 [redacted]

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[redacted] The first operational training firings which can be identified [redacted] occurred in July 1958. It is also believed that the 700 n.m. missile was displayed in the Moscow Parade on 7 November 1957.

Assuming that the production buildup for the 700 n.m. weapon system began in 1956, the Soviets could have established a considerable operational capability by the present time. Although specific evidence of the location and rate of production of this missile is lacking, it is estimated that by mid-1959 the Soviets would have had an initial salvo capability of about 75 missiles with the 700 n.m. weapon system, with more than three times that number having been produced to meet operational inventory requirements, in addition to production for the test firing program. There is some evidence that a unit of the Soviet Long-Range Air Force may have been equipped or about to be equipped with this missile in early 1959 and there is also inconclusive evidence of the possible deployment of 700 n.m. missiles in East Germany. The relatively small force level estimated above for mid-1959 is based primarily upon a judgment of Soviet military requirements, rather than production capabilities, inasmuch as this missile system could have been produced in considerably larger numbers than those estimated.

D. The 1,100 n.m. Weapon System Program: Industrial Implications

Firings of the 1,100 n.m. weapon system at Kapustin Yar indicate that a considerable degree of time compression occurred in this program as compared with a similar time span of the 700 n.m. program. (See Figure 1.) The time elapsed from the first noted firing to the 1,100 n.m. range in mid-1957 until the first limited research and development missile was flown in December 1958 comprised only one-half the time covered by the comparable period of about 36 months for the 700 n.m. program. Roughly the same ratio applied to the time interval between initial firing and first firing [redacted]

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This program compression has considerable significance, inasmuch as it implies that a unifying and common philosophy of development and production runs through these programs. It must be concluded that a considerable part of the technical competence and production skill acquired in one program is successfully carried over and applied to the development of the next, more complex system. While the amount of specific missile hardware and production equipment which one system furnishes another cannot be determined, it is probable that the 1,100 n.m. missile production program has benefited substantially from previous Soviet experience with the shorter-range vehicles. [redacted]

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The rate at which this program has progressed strongly indicates that preparation for series production of operational vehicles was undertaken concurrently with the early production of missiles for testing purposes. It is also likely that many, if not all of the test missiles were produced by assembly line techniques, thus permitting production of operational vehicles from the same assembly line. Although there was a nine month gap in the test firing program (September 1957 - April 1958), the rate of firing which followed it required the existence of a production facility capable of quickly building up its output rates. Of the total of almost 50 firings of this missile since mid-1957, over half occurred in 1959 and the rate has approximately doubled each year. An average output of about 5 missiles per month was probably required merely to sustain the test firing program during 1959.

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Present estimates of the most probable Soviet deployment program for the 1,100 n.m. missile would require the production of about 10 missiles per month at the present time.

E. The ICBM Weapon System Program: Industrial Implications

It is currently estimated that series production of ICBMs and other system equipment for operational use is probably already underway in the USSR. This estimate of the status of the Soviet ICBM production program is based on indirect evidence of the possible location and timing of ICBM production, various statements of Soviet leaders on the status of the ICBM program, knowledge of Soviet industrial programs and practices, and the belief that the Soviets are following an orderly and effective ICBM program intended to acquire a substantial capability at the earliest reasonable date.

Since the first Soviet ICBM firing in August 1957, the Soviets have fired 25 ICBMs, as well as 11 vehicles associated with their space effort. In 1959 alone, 17 ICBMs were fired, in addition to 4 space vehicles. Soviet production of ICBM vehicles necessary to sustain just the observed ICBM firings in 1959 must have amounted to at least an average of about two missiles per month. This monthly output would probably be doubled in practice by pipeline, maintenance, static test, development and training demands. If the Soviet space vehicles are employing ICBM hardware, this would require additional output from the ICBM production facility or facilities.

There is insufficient evidence to state with any degree of certainty whether all Soviet ICBM output originated from a single facility or initially from a development facility and later from a production facility. There is evidence that the cities of Moscow, Sverdlovsk, and Kuybyshev are centers of some activity of major significance to the Soviet ICBM and/or space flight program.

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Regardless of facility status, it is apparent that no later than the end of 1958 an ICBM production line was in the process of organization with its basic tooling, jigs, fixtures, material flows and labor force. No other known industrial method of fabrication and assembly of missiles of intercontinental range could provide the production capability reflected by the high rate of firing at Tyuratam during 1959.

There have been several statements made by Soviet leaders in the past year regarding the status of the Soviet ICBM program. Notable among these have been the official statements dealing with ICBM production made by Khrushchev in late 1958 and early 1959. In November 1958, Khrushchev stated that "in the Soviet Union the production of intercontinental ballistic rockets has been set up successfully". In February 1959, in discussing the final draft of the Seven Year Plan before the 21st Party Congress, this wording was altered to state: "In the Soviet Union the serial production of the intercontinental ballistic rocket has been organized." In his concluding remarks to the Party Congress a few days later, Khrushchev added this statement: "When we say that we have begun serial production of intercontinental ballistic missiles, it is not just to hear ourselves talk. And we do not say this to threaten anyone, but in order to clarify the true state of affairs."

Although there is no direct evidence indicating precisely when serial production of ICBMs for operational use began or probable production rates, it is now estimated that for planning purposes it should be considered that Soviet achievement of an initial operational capability with a few -- say, 10 -- series produced ICBMs will have occurred by 1 January 1960. Under these conditions, organization of production resources for the planned buildup of ICBM production to a preselected peak rate would have begun no later than the middle of 1959 on the existing production line and possibly at some earlier date as implied by Khrushchev. Output of the first operational missile would probably have occurred by at least early in the last quarter of 1959 and the production rate would increase fairly rapidly during 1960. The Soviet ICBM program now estimated to be most probable would provide the USSR with an initial salvo capability of ICBMs by mid-1961.

Production of this number of missiles might require an additional production facility to meet operational inventory requirements, as well as continued testing and other needs. If required, such a facility would have already been designated and should now be in preparation for production.

F. Submarine Missile Weapon System

There is no information relating to the historical development of a production program for guided missile systems intended for use with a submarine launching platform. Current intelligence related to the problem suggests that a few submarines from two existing classes were converted to launch guided missiles, and that a new class of submarine which is currently being produced may be intended for that purpose. Although some information is available with respect to these submarines, there is no evidence regarding the production of missiles for them and no present indication that other than short-range missiles are involved in these programs.

G. Aerodynamic Long-Range Missiles

Although fragmentary evidence is available concerning Soviet activities in the field of cruise missiles dating back to the assembly of German V-1 missiles in 1946-47, there is no information available regarding past or present Soviet production programs for aerodynamic long-range missiles.

Soviet Long Range Missile Programs - Time Phasing and Milestones